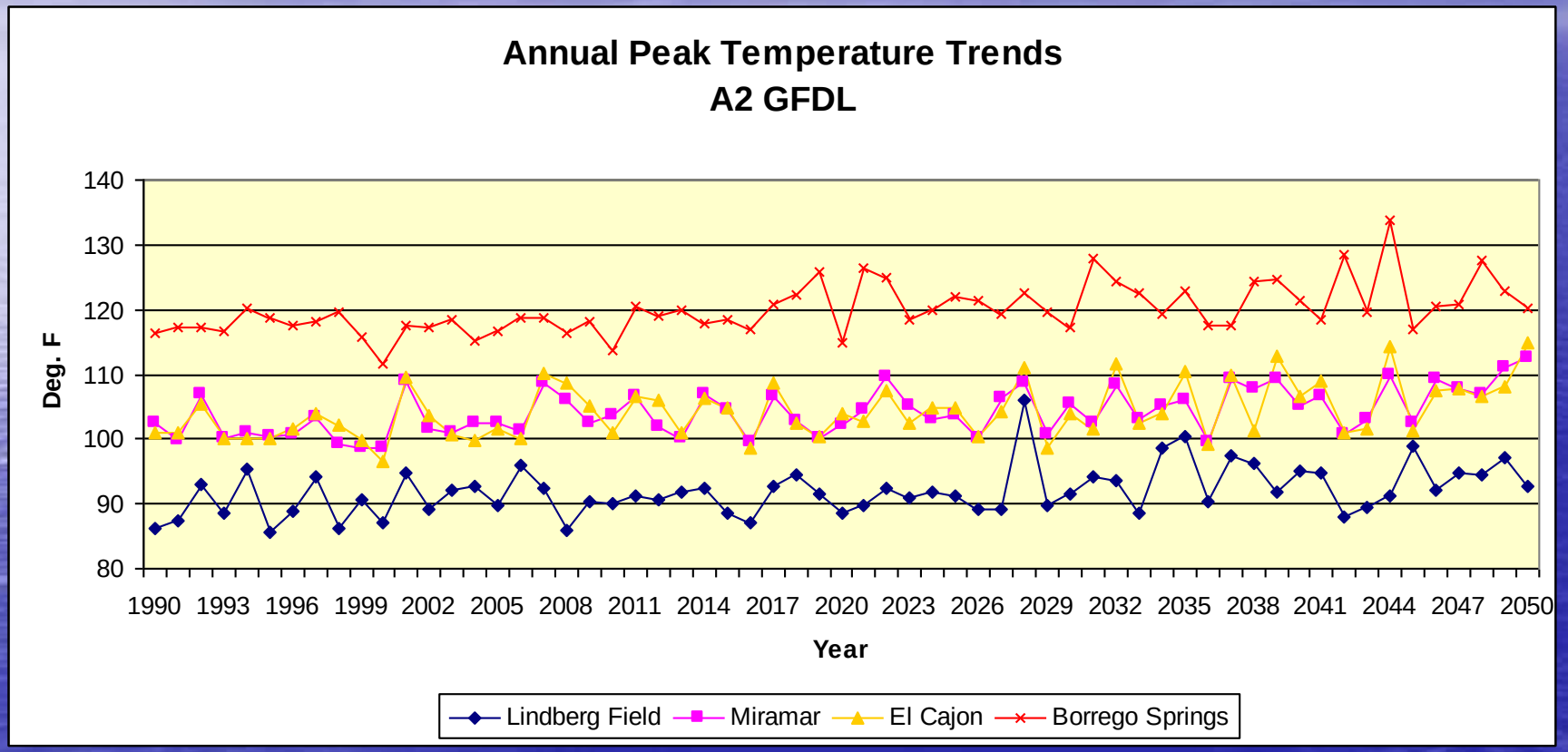
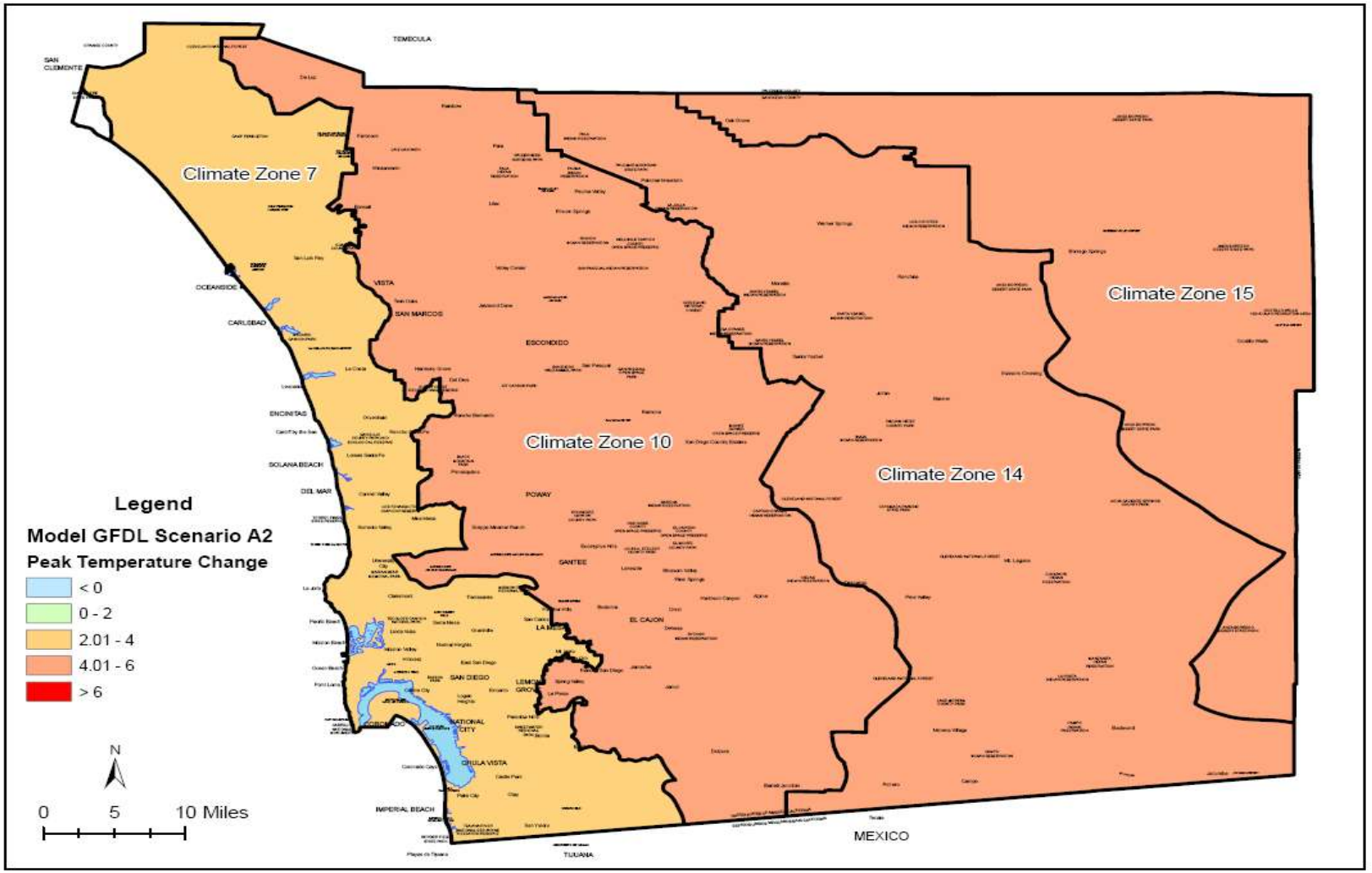
Energy-Related Climate Change Impacts

John Westerman
Vice President
Horizon Energy Group

Focus 2050 Study Temperature Forecast

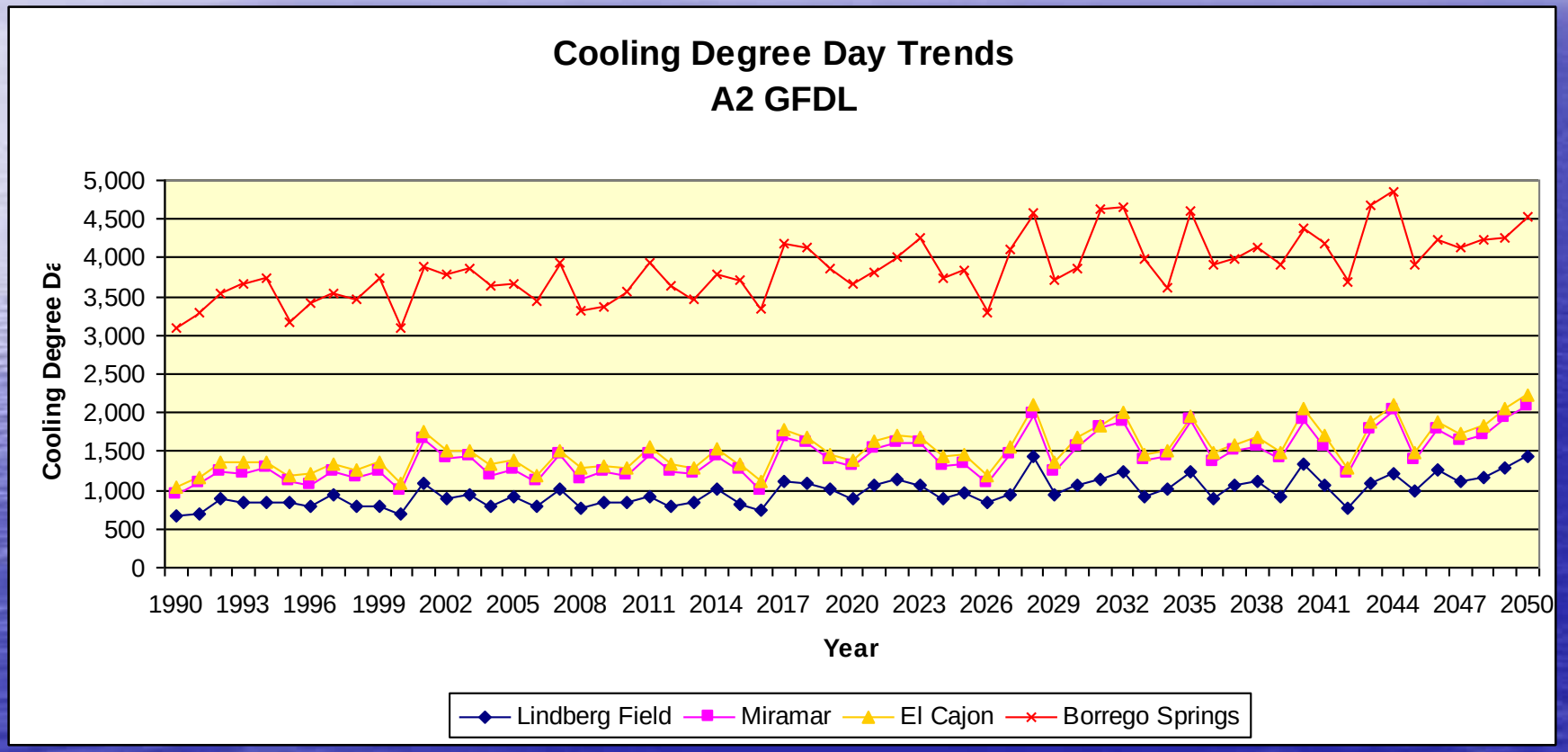


Focus 2050 Study Temperature Forecast

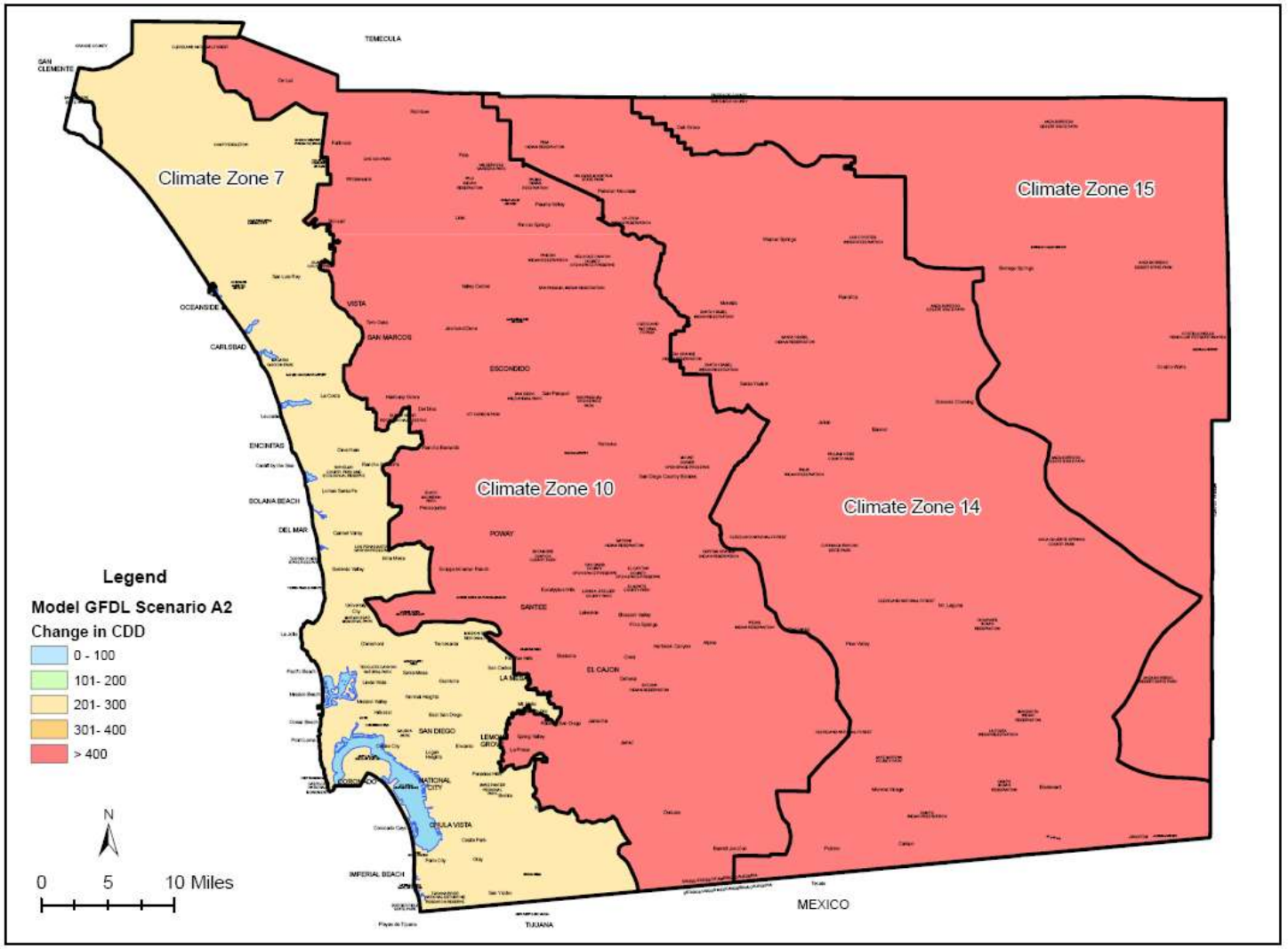


Change in Peak Temperatures by 2050 Model GFDL Scenario A2

Cooling Degree Day Forecast

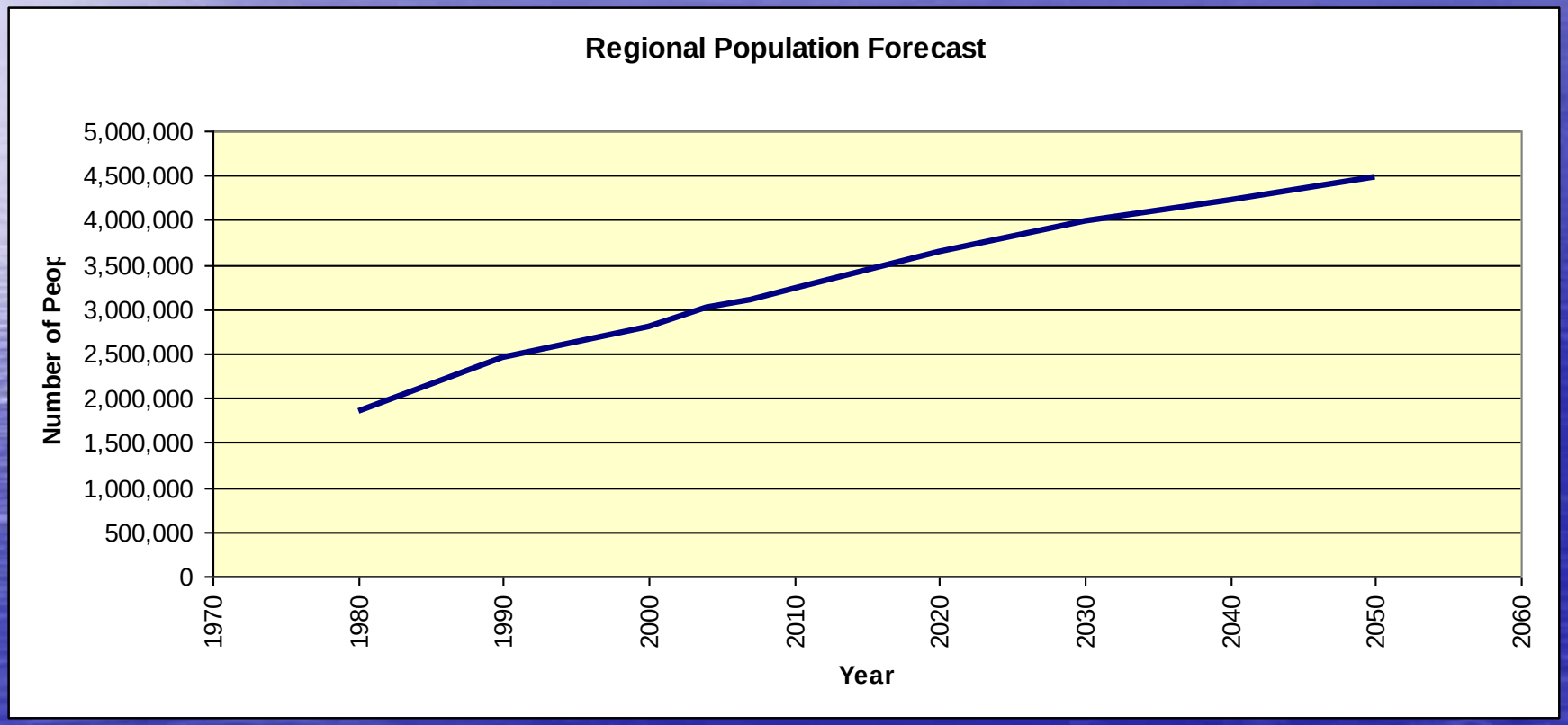


Cooling Degree Day Forecast

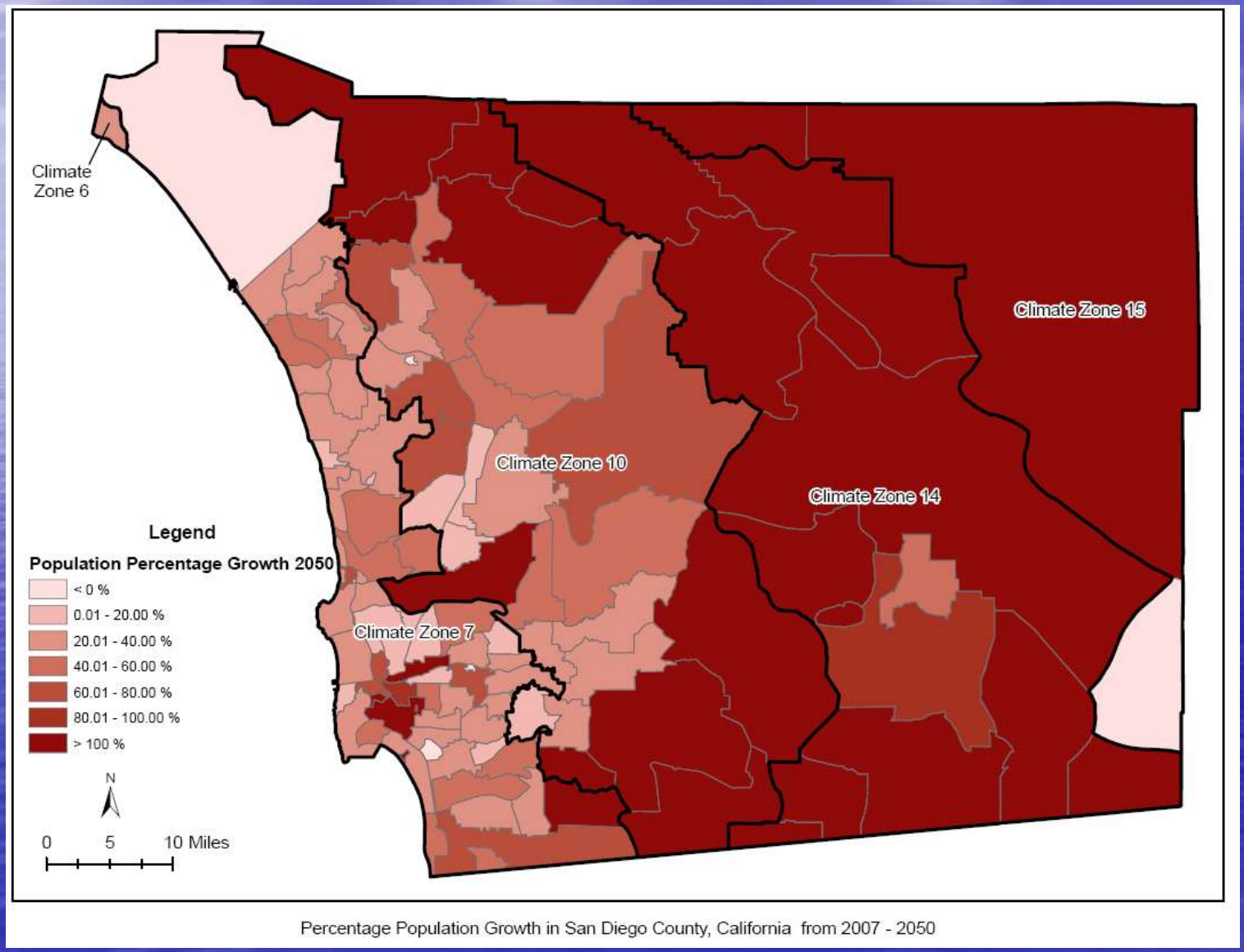


Change in Cooling Degree Days by 2050 Model GFDL Scenario A2

Population Forecast

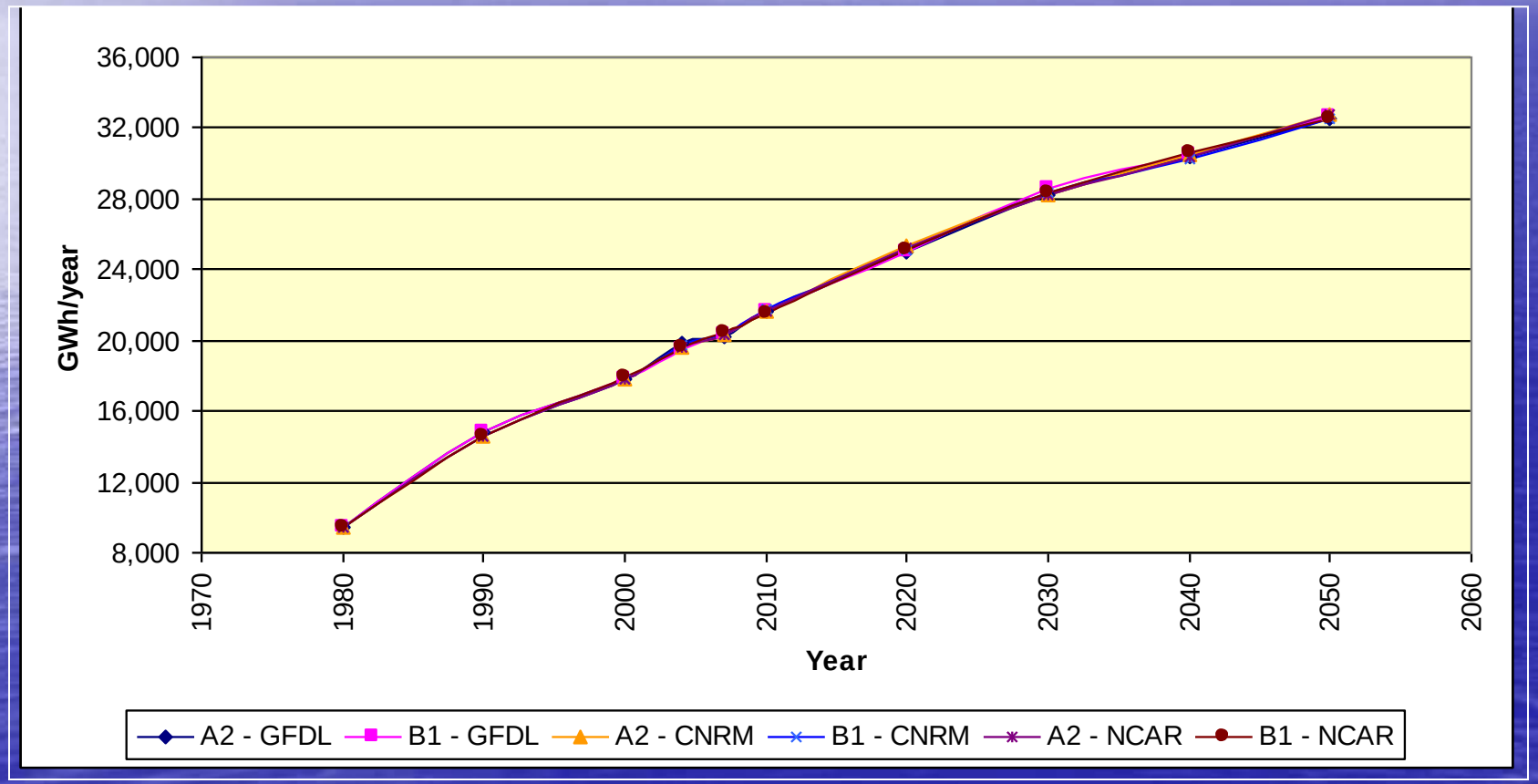


Population Forecast (% Change)

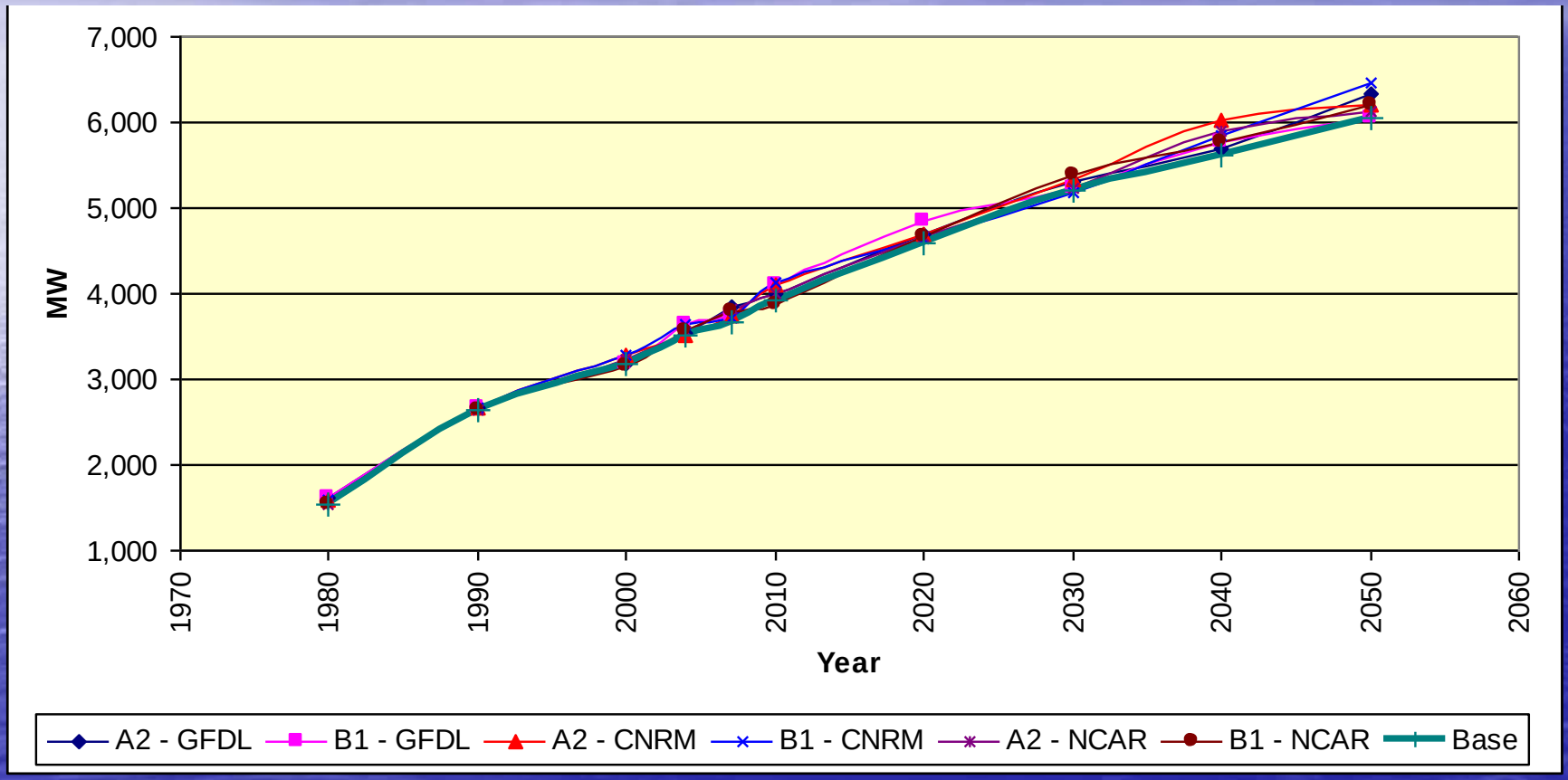


Percentage Population Growth in San Diego County, California from 2007 - 2050

Model Results – Electric Consumption

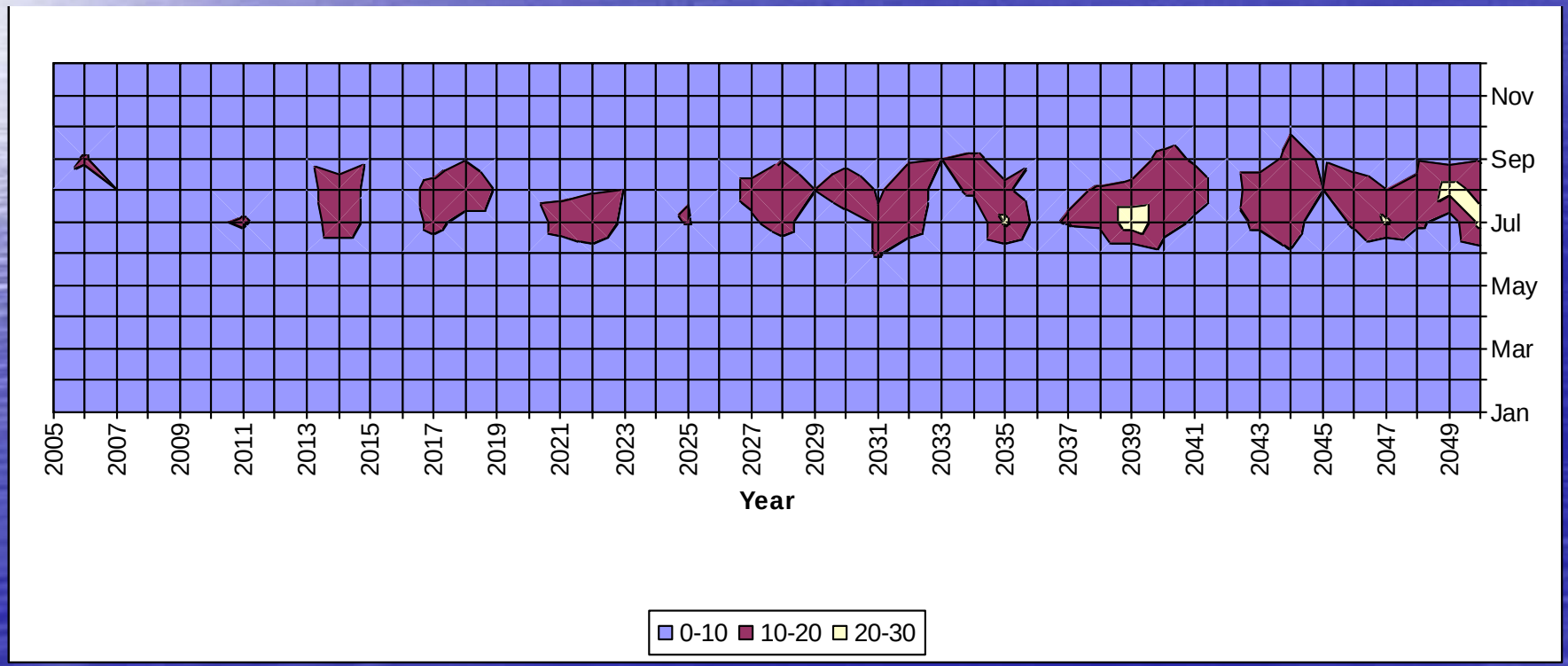


Model Results – Electric Demand



Model Results – Electric Demand Events

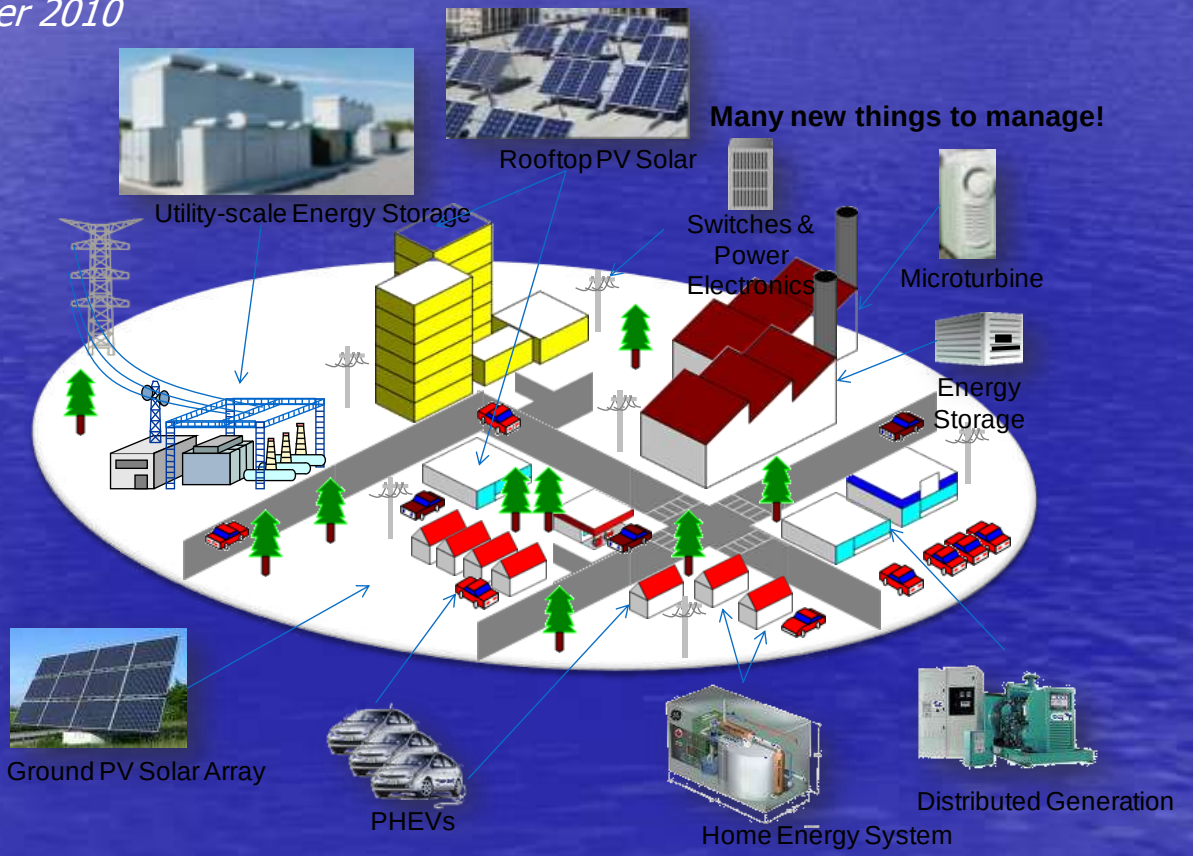
One in Ten Peak Demand Events



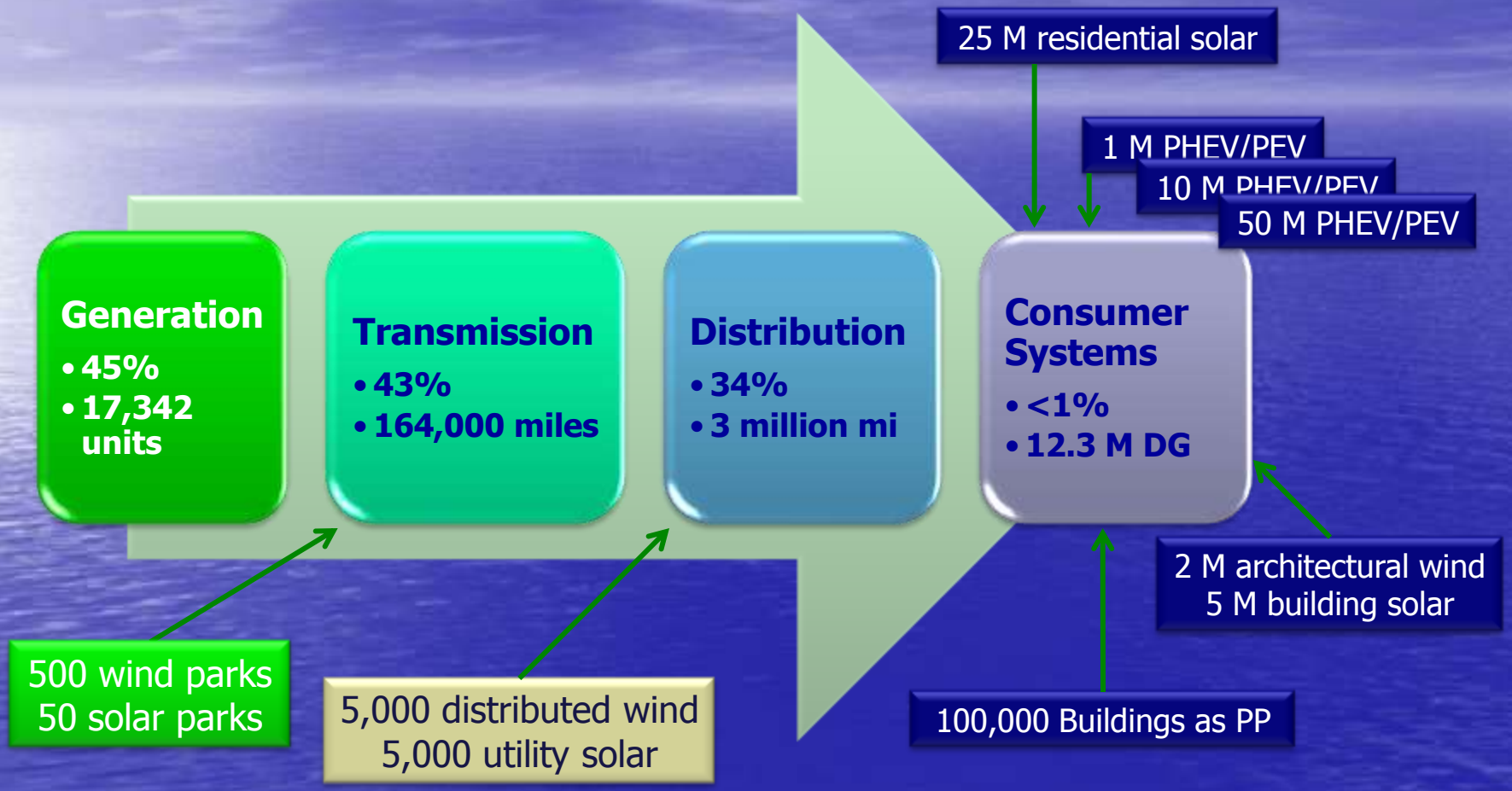
What is a Microgrid?

"A **microgrid** is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode."
Microgrid Exchange Group, October 2010

There are federal and state incentives and tax credits for microgrids.



From the 20th to the 21st Century



Why Microgrids?

- **Savings**: The microgrid portfolio of resources is tuned to the complex to provide economic savings
- **Sustainability**: The microgrid portfolio enables a hedge against fuel cost increases
- **Stewardship**: The microgrid enables a high level of penetration of renewables
  - Emissions reduction
  - Green marketing
- **Reliability**: The microgrid actively controls the network for better reliability

Microgrid Objectives

Utility Network Management

Microgrid Objectives
Take action to improve reliability
Take action to improve economics
Take action to manage renewables

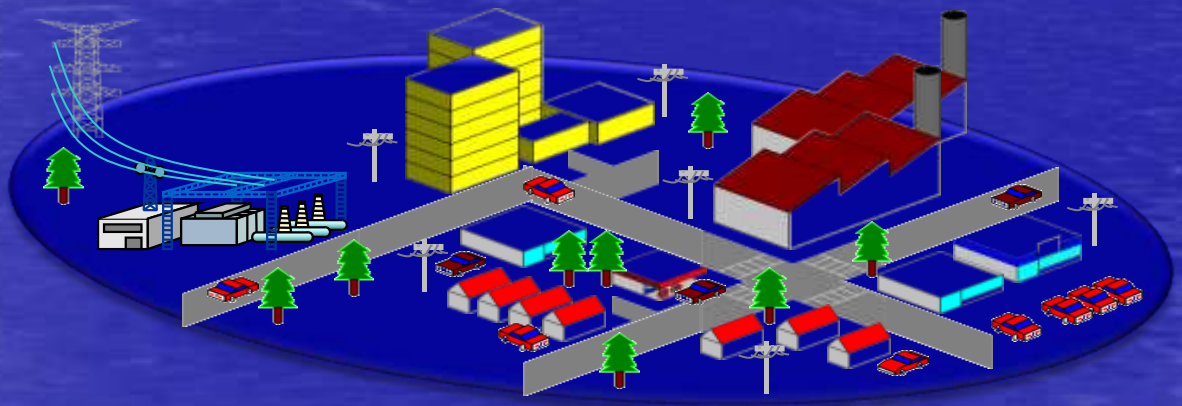
Microgrid Master Controller

SCADA System

Distributed Energy Resources
Utility-scale Energy Storage
Rooftop PV Solar
Micro-turbines
Building Energy Storage
Community Energy Storage
Distributed Generation
Home Energy System
PHEVs
Ground PV Solar Array

Information
Electricity Pricing
DER status
Demand Response Programs
Network status
Community Objectives
Load and Resource Profiles

Grid Resources
Capacitor Banks
Voltage Regulators
Automated Switches
Power Electronics
Communications



Contact Info

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Horizon Energy Group is a key contractor on the DOE Smart Grid Implementation Strategy Team

Horizon Energy Group Principals are Certified Navigators for Carnegie Mellon's Software Engineering Institute's Smart Grid Maturity Model

Horizon Energy Group named in 2008 as a Company to Watch in the book, "Perfect Power" by former Motorola Chairman, Bob Galvin, and former EPRI CEO, Kurt Yeager.

Horizon listed in 2009 as one of the "Top 100 Movers and Shakers in the Smart Grid Movement" by GreenTech Media.